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ABSTRACT

The System of Interactive Guidance and Information (SIGI) has been implemented at the National Technical Institute for the Deaf (NTID) to study its effectiveness and utility with a hearing-impaired college population. SIGI is composed of six interrelated subsystems: values, location, comparing, predicting, planning, and strategy. Each subsystem has two functions: to organize and dispense information and to teach the decision-making process. In the 3 years SIGI has been in use, different implementation strategies have been tried, including totally independent student interaction, requirement as part of a career decision-making class, and counselor-student use. Each approach has been successful for some students. Four evaluations have been conducted. The first shows positive student and counselor attitudes and the need for a pre-session or concurrent support. The most important finding of the second evaluation is the lack of difference between SIGI and non-SIGI students on their "goodness of career decision." Some findings from the final two studies are that reading comprehension was the biggest problem and that some jobs that students were interested in were not available. Future plans include a data summary program for SIGI and research on characteristics of students who can satisfactorily use SIGI. (YLB)

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SIGI at NTID: Computer Assisted Career Guidance with Hearing-Impaired College Students

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Abstract

This study investigated the effectiveness and utility of one particular computer assisted career guidance system with a hearing-impaired college population; the System of Interactive Guidance and Information (SIGI). The report provides: a brief overview of the SIGI system, a discussion of why SIGI was chosen to be part of the counseling services provided to NTID students, a discussion of how SIGI is currently being implemented at NTID, and a review of research that has been conducted with SIGI and will be conducted in the future. Additional information is available upon request from the authors.

SIGI at NTID: Computer Assisted Career Guidance with Hearing-Impaired College Students

The use of computerized delivery systems as an adjunct to career counseling is a topic of current interest and speculation (Harris, 1974). Career counseling must provide not only occupational information but also an adequate assessment of an individual's self and his likes and dislikes.

A vast amount of information must be made available to provide students with adequate input so that they can not only assess their own needs, but those of the job market and the requirements of training for acquiring a job. It is unrealistic for one person to be able to provide the variety of information with the speed and accuracy that is necessary to meet the needs of students making inquiries concerning specific career areas, while holding students' interest (Walter, 1976). For this reason, there are clear benefits to be gained from the power of a computer to store large amounts of information, provide immediate access to it, and adjust to the individual needs of students. Computer hardware and software has now reached a stage where such systems are potentially applicable for assisting the career counselor in providing services to counselees.

In 1978, the National Technical Institute for the Deaf -- one of the colleges of the Rochester Institute of Technology -- acquired the System of Interactive Guidance and Information (SIGI). SIGI was developed by Martin Katz at the Educational Testing Service and its use at NTID was the first major implementation of the program with hearing-impaired students.

This report summarizes what has been learned from four years of working with SIGI and includes both the results of research and the results of experience.

An Overview of SIGI

The System of Interactive Guidance and Information, or as it is more commonly called -- SIGI -- is a computer-based aid to career decision making. The system was designed by Educational Testing Service (ETS) to apply computer technology to assist people in examining their work values, exploring a variety of career options, evaluating relevant occupational data, and formulating tentative career plans. SIGI initially was intended for use primarily by community college students. Very early in the developmental planning stage, this was expanded to include four-year college students. Additional materials currently are being develped to further expand the use of SIGI to include adults who are changing carers or returning to the job market.

SIGI is made up of six interrelated subsystems: Values, Locate, Compare, Prediction, Planning, and Strategy (See Table 1). The first time a student uses SIGI, he/she must proceed through each subsystem in the prescribed order. After having progressed through SIGI one complete time, a student is able to wander freely through any of the subsystems as often as desired. It typically takes a student 2 to 4 hours to go through all the systems one time.

Two of the SIGI subsystems, Prediction and Planning, are made up of information specific to the institution using SIGI. The Prediction system is comprised completely of local information and the Planning system is comprised of approximately 50% local information. At the present time, NTID has not included any local information.

TABLE 1

The SIGI subsystems and their place in the decision-making paradigm*

Subsystem	What the student does	Step in the decision-making process
(Introduction)	Learns concepts and uses of major systems.	
1. VALUES	Examines 10 occupational values and weights the importance each.	Find out what you want.
2. LOCATE	Puts in specifications for 5 values at a time and gets lists of occupations that meet the specifications.	Find out where you can get what you want.
3. COMPARE	Asks questions and gets specific information about occupations of interest.	Get information for judging the advantages and disadvantages of your options. Narrow down your list of options.
4. PREDICTION[1]	Finds out probabilities of getting various grades in key courses of programs that prepare for occupations.	Assess the probabilities of success for each option.
5. PLANNING[2]	Sees the steps to be taken to prepare for an occupation, including the program at the local college.	Plan a course of action for each option.
6. STRATEGY	Evaluates occupations in terms of the rewards they offer and the risks of trying to enter them.	Apply a rational decision-making strategy to occupational choice.

[1]This subsystem is currently not available on the NTID version of SIGI.

[2]This subsystem currently exists in an abbreviated form on the NTID version of SIGI.

*Table 1 from: Slusher, N.L., & White, K.R. A preliminary evaluation of the system for interactive guidance and information with NTID students. Unpublished manuscript, National Technical Institute for the Deaf, 1978.

Each subsystem has two functions. The first is to organize and dispense information. In this respect, the systems are more or less independent of one another. The Values subsystem helps students organize their values without regard to any specific occupation. The Locate subsystem lists occupations on the basis of their potential to satisfy certain values, but it does not contain any other kind of occupational information. The Compare subsystem is a kind of encyclopedia of information, it is not confined to the Values dimensions. Each system occupies a separate realm.

The second function is to teach a step in a decision-making process. In this respect, the subsystems are very much interdependent. The purpose of each is defined by the place it occupies in the process. Thus, the Locate subsystem depends for its effectiveness on the students having previously determined which values are important to them. The Compare System becomes impossible unless students know what occupations to ask about. Although a system can be detached and used as a separate resource when the purpose is to get information, it cannot be removed from the context when the purpose is to learn the decision-making process.

This duality of function is obviously important in counseling. Some students may need factual information that one part of the SIGI system can supply. Others may need the whole paradigm for decision-making or may lack insight at some step in the process. The purposes for which the SIGI system is used depends to some extent on the ability of the counselor to use it in different ways to meet different needs.

Thus, SIGI is both a career guidance system and an occupational information system. Its aim is to produce an autonomous individual capable of making rational decisions.

Students interact with SIGI via cathode ray tube terminals. Displays are presented on the terminal and students may either respond to a question, ask a question, or give directions to the computer by pressing the designated key. The pace of SIGI is flexible and is controlled by the individual user. The text within SIGI is at the eighth-grade reading level. The SIGI program has the ability to record all the responses a student makes and to make reference to this information at various points in the program.

The decision to bring SIGI to NTID

Very early in the history of NTID, it was recognized that a vast amount of occupational information must be available to NTID students in order to provide for their career education needs. It was also recognized that there are clear benefits to be gained from the power of a computer to store large amounts of information and to provide access to this information.

As early as July, 1974, SIGI had been identified for possible use at NTID. In the ensuing three years, a task force intensively studied SIGI and its potential for use within NTID. The work of the Task Force included gathering as much information as possible from institutions that were then using SIGI and from field tests of SIGI conducted by the Educational Testing Service. The Task Force also arranged for eight NTID students to visit ETS and spend two days interacting with SIGI. This interaction was closely observed by members of the Task Force which included career counselors and language specialists. Two members of the Task Force also conducted an assessment of the SIGI occupational data base.

Based on the above information, the Task Force recommended that SIGI be brought to NTID, although they cautioned that, in order to be successfully implemented in this environment, certain support services, such as a counseling coordinator, a resource assistant and a research associate, were necessary to assist NTID students in effectively using SIGI. The recommendations of the Task Force were released in the Fall of 1976.

During 1977, plans for implementing SIGI at NTID were carried to completion, and SIGI was in place and operational at NTID in March of 1978.

Implementation of SIGI at NTID

A PDP-11 mini computer, five CRT terminals and four printers were purchased by NTID for use with SIGI. The computer and one terminal are installed in the NTID computer room and are not accessible to students. One terminal and printer are located in the counseling center at RIT and are available to all RIT students. The other three terminals and three printers are for use only by NTID students. Recently, equipment was purchased that allows the movement of SIGI terminals and printers to other locations within NTID at RIT.

SIGI falls under the auspices of the Department of Career Exploration, which is part of Special Programs. The counseling implementation activities related to SIGI and the daily management of SIGI are handled by a SIGI Specialist. The SIGI Specialist is a professional counselor who maintains a small caseload of vocatinally undecided students in addition to SIGI responsibilities.

During the three years that SIGI has been in use at NTID, several different implementation strategies have been tried, including:

(1) totally independent student interaction with SIGI;

(2) use of SIGI during the Summer Vestibule Program;

(3) SIGI required as part of a career decision-making class;

(4) counselor and student going through SIGI together;

(5) pairs of students going through SIGI together;

(6) SIGI as extra credit in other courses.

Each approach has been successful for some students and not as successful with others. SIGI appears to have been most useful with the more flexible approaches that can be adapted to match an individual student's skill level. This skill level includes both reading level and decision making and career knowledge skills. The potential for SIGI to assist NTID students in making career decisions exists, but the high reading level and sophisticated conceptual tasks are often detrimental.

Speaking from a counseling point of view, we have found that students often do not use the system to their own best advantage. They are often willing to accept at face value, information from the computer without probing either themselves or the computer for more information or clarification. We need to teach NTID students analytical thinking skills to asist them in the SIGI decision-making process. Off terminal supports such as SIGI curriculum and SIGI workbooks have been developed to accomplish this task.

At the same time, some students with more sophisticated skills have used the computer in a very supportive manner to learn more about their values

and to change majors to reflect their new awareness of what is important to them in an occupation.

Based on the knowledge we have gained about SIGI over the past year, the following areas stand out at this point as areas needing further modification during the coming years:

1) A revised curriculum for SIGI-related courses. How can SIGI best be used to complement and not repeat the already existing career decision-making class. A future direction would be to offer two sequential decision-making courses. The first would be of an introductory nature and the second more intermediate course would center around SIGI.

2) Discussion of possible modifications to the SIGI system itself. There are two possible kinds of modifications. The first would be to develop the local Planning and Prediction subsystems. The other is to rewrite the language level. We need to decide if both modifications should be made together or if there is a greater need for one modification initially.

3) More in-depth evaluation of how well students are able to learn from SIGI. It is clear that students are learning from SIGI. We need to find out which areas within the system need more off-terminal support and clarification.

4) More conclusive evidence of the career decision-making status of the students who can best use SIGI. Is SIGI good only for students who are considering changing their major or are there features of SIGI which can also benefit students satisfied with their major.

5) Counselor interaction with SIGI. There may exist times we are not now aware of when counselors could use SIGI and they presently are not. If these situations do exist, we need to find out and develop another method of implementations to accommodate that area.

Additional information concerning the strengths and weaknesses of various implementation strategies is available from the SIGI Specialist. Most of the students who use SIGI have learned about it from their counselors or by word of mouth from other students.

Research with SIGI at NTID

SIGI was installed at NTID in January of 1978. Plans for the evaluation of SIGI went into operation almost immediately. This section summarizes the results from four evaluations conducted with SIGI since 1978. The first such evaluation was conducted during the spring quarter of 1978 (February to May). During that quarter, 23 students completed SIGI and 5 career counselors and the newly hired SIGI Specialist were involved with the program. This first evaluation, conducted by Nancy Slusher and Karl White, was summarized in a report released in June of 1978. Slusher and White conducted interviews with the students and career counselors. They also photocopied actual frames that appeared in SIGI and asked students to interpret them in order to get some feel about how well students understood SIGI. The following section is taken from the summary of the Slusher and White report.

> Both students and career counselors report that they feel very positive about the potential use of SIGI at NTID. SIGI is viewed as both helpful and interesting. Students mention a number of specific and tangible ways in which SIGI was helpful (e.g., for examining values, relating values to jobs, acquiring job information, and making career decisions). Counselors pointed out the general processes which are aided with the use of SIGI (e.g., the decision-making process, the framework and structure for career exploration, and developing independence) in addition to making many of the same observations which were made by the students (emphasis on values and their relationship to careers, the accessibility of career information, etc.)
>
> The weaknesses of SIGI and areas in need of improvement were also viewed similarly by students and counselors. Both agree that it would be helpful to include more NTID-related information, expand and/or include the planning and prediction system for NTID, and simplify the language. In addition,

counselors mentioned the importance of using SIGI as only one part of the total career counseling program. One of the most important findings from this preliminary evaluation of SIGI is the fact that, although virtually all students really liked SIGI and thought that it was a worthwhile experience, most of them had significant difficulty understanding and comprehending important parts of the various subsystems. The amount of difficulty which students experienced was strongly correlated ($r = .714$) with their reading comprehension scores. Only about 35% of the students comprehended 75% or more of the material which was selected to assess students' comprehension of SIGI. This suggests that students with low levels of reading comprehension will have significant difficulties comprehending and gaining the full benefit of SIGI in its present form.

This evaluation was viewed primarily as a preparatory study for a more complete evaluation of the fully operational SIGI system conducted during the summer of 1978. The preliminary results were encouraging. SIGI was enthusiastically received by both students and counselors and was viewed as a valuable addition in helping students to make career decisions.

In addition, those preliminary results suggested that it may be necessary to provide some kind of pre-session, on terminal, and/or concurrent support for many of the students at NTID if they are to obtain maximum benefit from SIGI. Such activities were already being planned for use with SIGI during the summer of 1979 and provided a valuable addition to the total program.

Finally, the report provided a foundation upon which the summer evaluation and future research activities were built. For example, information about the importance of minimum levels of reading comprehension and vocabulary needed to be pursued further, questions about which parts of SIGI are most difficult or confusing needed continued investigation, and the reactions of those students who begin but do not complete SIGI needed to be more carefully considered.

The second evaluation of SIGI, also conducted by Karl White, took place in the summer of 1978. This evaluation was never written up into a report, however, the data was collected, summarized and verbally reported (some tables were also provided) to the SIGI Task Force (now called the SIGI Advisory Team).

During the summer of 1978, SIGI was incorporated as an integral part into four Career Planning Seminars (CPS) involving thirty-six students and five counselors. At the end of the Summer Vestibule Program (SVP), all SIGI students completed a questionnaire similar to that used in the spring evaluation. The questionnaire contained some attitude items as well as items testing student comprehension of SIGI concepts and language. In addition to completing the questionnaire, some students also participated in a personal interview to share their reactions to SIGI. Throughout the summer, counselors of the SIGI CPS groups kept notes on student reactions to SIGI subsystems.

During the interview, SIGI students were asked certain questions related to their reasons for making specific career decision. A group of non-SIGI students were also interviewed in a similar fashion. Counselors then rated the transcripts of the interviews to obtain a measurement of the "goodness" of the students' career decision. No significant differences were found between the responses of the group of SIGI students and the group of non-SIGI students.

Results of this second evaluation were similar to those of the first evaluation regarding students' attitudes. Students liked SIGI, and found it useful in clarifying values. The most negatively noted impact of SIGI

was its inability to provide information about NTID-related jobs. Additionally, students mentioned problems with directions that were confusing and difficult to understand, and words used in SIGI which they did not understand. Perhaps the most important result of the summer evaluation was the lack of difference between SIGI and non-SIGI students on their "Goodness of Career Decision." Factors contributing to this result would include problems of measurement involved with determining how "well" students can make career decisions, the large number of forces that impact on a student's ability to adequately make such decisions (of which the summer CPS groups are only one such force), and the relatively short amount of time available for students to comprehend and practice the skills taught in SIGI. Based on all of the above, we cannot now (and probably will not be able to in the near future) say that SIGI leads to measurable differences in students' ability to make "good" career decisions when compared to students who went through CPS with an experienced counselor but without the use of SIGI.

Dr. White left the Institute in the Winter of 1978 and another Research Associate (the first author of this report) was assigned to the project in January of 1979. A proposal for the evaluation of SIGI over the next several years was presented in April of 1979.

Beginning in winter quarter, 1979, all students using SIGI completed a pre-SIGI questionnaire, and all students who went through the six subsystems of SIGI completed a post questionnaire. These questionnaires contain both affective and cognitive items. In June of 1980, two reports were completed summarizing the data from the pre- and post-SIGI questionnaires from winter, 1979, through winter quarter, 1980. The reports indicated that students continued to hold extremely positive attitudes toward SIGI. However, some

differences surfaced between summer quarter students (who use SIGI to help decide on a major) and other students (who use SIGI to find out about possible jobs in their major). Additional findings from these studies were:

1. In any given quarter, we can expect half the students who use SIGI to be first year students trying to make a decision about their initial major at NTID. The remaining students will be divided between those students who are unhappy with their current major and are looking for another major, students who are using SIGI because it is required for a course, and students who are simply curious about SIGI and/or want to find out more about future jobs related to their majors.

2. Summer quarter student users are different from those students who use SIGI during the remainder of the year. In comparison to academic year users, more summer quarter users indicated they wanted to find out if they had chosen the right major (or obtain information to help them choose a major) and they were also significantly less interested in possible future jobs.

3. The majority of students who have a current major indicate they are satisfied with their major and want SIGI to give them information about future jobs in that major.

4. The biggest problem students reported with SIGI centered around reading comprehension, although the particular questionnaire items used to express this problem varied from quarter to quarter.

5. Students consistently give SIGI the highest grades (largest proportion of A's and B's) in the following areas:

   a. Helping decide which occupations to prepare for.

   b. Showing how values are related to career decisions.

   c. Getting information about occupations.

6. Students consistently give the lowest grades (largest proportion of D's and F's) in the following areas:

   a. Giving information about NTID programs.

   b. Helping estimate how successful you might be in different majors.

7. From 18% to 44% of the students each quarter indicated there were jobs they were interested in that were not available on SIGI. Some of the jobs listed were available on SIGI under slightly different names, others were not.

8. The aspect of SIGI that students liked best varied from quarter to quarter. The following were the most frequently checked responses:

   a. SIGI was better than reading books to find out about jobs.

   b. Getting information quickly about jobs.

   c. Relating values, abilities, and interests to jobs.

9. In general, from 70 to 80 percent of the students could correctly match the values given in SIGI with the definition of those values. Since these values are introduced in the first subsystem and used throughout SIGI, this is both an important and reassuring finding.

10. Most of the students could correctly pick out the five steps of the "decision making process" that SIGI teaches from a list of seven such steps. However, from 42 to 37 percent of the students could not put these steps in a reasonable order.

11. Both the concept of "values" and the definition of the specific values taught in SIGI are understood by most of the students who have used the system during the four quarters under question. However, the concept of "process," or at least "career decision making process," is not understood by almost half of the students.

Recommendations based on these reports included:

1. There appear to be distinct differences in undecided students attempting to choose their first major and second or third year students interested in changing majors or finding out about possible future jobs in their majors. Once a permanent computerized SIGI data base is established, the information should be analyzed separately for these two groups. It might be useful to develop two introductory packages for SIGI, each taking into account the differing needs and expectations of the two groups.

2. Eventually, NTID will have to seriously consider simplifying some of the language used in SIGI. This could be done most feasibly when the Prediction and Planning subsystems are implemented for our students. We should continue to explore the possibility of Gallaudet and ETS helping

us to finance such a rewrite. We could conceivably plan such an undertaking after NTID's Foundation Program has been in operation for a year or more. Gallaudet will have had several years of experience with SIGI and we should have the necessary test prediction information to implement the SIGI Prediction subsystem.

3. Students need to be encouraged to jot down any and all questions they would like to ask SIGI. They then need a planned opportunity to discuss these questions with a teacher, counselor or the SIGI Specialist. Currently, we do not know what such questions might entail, but we do know that the ability to ask SIGI more questions is the most frequently mentioned response when students are asked what there is about SIGI that they would most like to change.

4. SIGI student proctors and those counselors who work with SIGI should keep a log of all questions SIGI users ask while they are at the terminal. This log could then be used to determine the nature of the questions (e.g., counseling, technical assistance, comprehension) that students want to ask SIGI.

5. There are three comprehension items on the post-questionnaire that deal with the definition of values and three items that cover the concept of a "decision making process." A method should be devised to obtain a total score for each of these sub-areas.

6. Beginning in the Fall quarter, we should have a computerized SIGI data base. We have now learned all we can from simple hand scoring of the forms and are ready for more sophisticated analysis. That would mean keeping the pre- and post-items constant for three or more quarters in order to obtain enough subjects.

7. The SIGI data base mentioned above should include: student responses to the pre- and post-SIGI questionnaires, background characteristics of the students, types of off terminal support given the students (e.g., taking SIGI for a class, discussion with counselors, etc.) and hopefully, the internal student response information that SIGI collects.

Plans for Future Research with SIGI

ETS programmed SIGI with an optional data collection routine that enables that machine to automatically record student responses to most of the displays. However, the method of storing that information does not allow for summary of the data across students. During the past six months, the Research Associate assigned to the SIGI project has been coordinating the development of a computer program that will make such data summary feasible. When all the bugs are worked out of the program, it will enable NTID to answer a wide variety of questions concerning students comprehension and use of the various subsystems of SIGI. The data collection option will also be used with a limited number of RIT students and Genesee Community College students to provide a comparison group of normal hearing students. The flexibility of

SIGI and the complexity of some of the subroutines make the task of picking out certain similar pieces of information for all students extremely complex. It is hoped that the program will be operational by September 1982. (Original plans called for this task to have been completed by September of 1981, but this was overly optimistic.)

Once the problems with the internally stored data have been solved along with some other problems of collecting data from the comparison groups, research efforts will concentrate on answering the following questions:

(1) Do students continue to react favorably to SIGI? What method or methods of implementation of SIGI contribute most to a favorable reaction?

(2) What are the characteristics of students who can and cannot satisfactorily use SIGI?

(3) Is there a difference in student comprehension and use of the different subsystems of SIGI?

(4) Are there differences in the characteristics of students who use SIGI because they are referred by a counselor or teachers and those who use SIGI on their own initiative?

(5) Are there differences in attitudes and characteristics between those students who finish SIGI and those who do not complete all the subsystems?

It is planned that a major report on SIGI will be completed in fall, 1982. The report will answer the above questions and will summarize what has been learned about SIGI during the four years it has been at NTID.

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Bibliography of SIGI Materials and Reports

Developed at the National Technical Institute for the Deaf

Materials

*SIGI: What it is and How to Use It (booklet)

*How to Help Students with SIGI at NTID
A Manual for Counselors and Tutors

*SIGI Workbook (Textbook for SIGI Course)

*SIGI Decision-Making Course Curriculum
SIGI Student-Teacher Worksheets (Strategy for SIGI Course)

*Pre-SIGI Student Questionnaire
*Post-SIGI Student Questionnaire

Reports

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